TINEA PEDIS-A CLINICO-MYCOLOGICAL STUDY

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CERTIFICATE

Certified that this dissertation entitled **"TINEA PEDIS -- A CLINICO MYCOLOGICAL STUDY "** is a bonafide work done by **Dr. B.T.PRIYA ,** Post Graduate Student in M.D. Dermatology, Venereology and Leprosy, Madras Medical College, Chennai – 600 003, during the academic year 2007 – 2010. This work has not been formed previously the basis for the award of any degree.

Prof.Dr.D.PRABHAVATHY, MD.DD.,
Professor and Head,
Department of Dermatology & Leprosy,
Madras Medical College,
Chennai – 600 003.

Prof. Dr. J. MOHANASUNDARAM, M.D., Ph D, DNB
Dean,
Madras Medical College,
Chennai-600003.

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CONTENTS

INTRODUCTION

Dermatophytosis is the superficial fungal infection of keratinized tissues caused by dermatophytes. They are a group of taxonomically related fungi that utilize keratin as a source of nutrients. Tinea pedis is a common superficial dermatophyte infection of the feet. It may present in several clinical varieties such as intertriginous, hyperkeratotic , vesiculobullous, ulcerative or a combination of these. It is often referred to as "Athlete's Foot".

Tinea pedis may be accompanied by dermatophyte infection of other parts of the body including groin, hands or nails. It is estimated to affect about 15% of the population at large, being more common in closed communities such as army barracks and boarding schools, in warm weather, among those frequently using swimming pools, and when the feet are occluded with nonporous tight fitting shoes.

In the west, tinea pedis is estimated to be present in about 40% of all patients who attend clinics for any medical concern [1]. Those patients with more severe symptoms seek medical help and often have concomitant fungal infection of the toenails [2, 3].

There are many undiagnosed cases, many of which may be asymptomatic and unsuspecting of having tinea pedis [2] and be a possible source of infection for others. Chronic infection is common in patients with concomitant diabetes, atopy, and immunosuppression. In an increasingly ageing population and with the increasing numbers of immune compromised patients, tinea pedis is emerging as an important and a significantly prevalent infection.

REVIEW OF LITERATURE

HISTORY

Cassius Felix in 400 AD first coined the term "tinea" to mean "Ring worm" in Latin [4]. In an extensive historical review , **Sabouraud**, the father of modern mycology cited **Horace** as stating that in Roman Times , the word tinea indicated the insects whose larvae feed on clothes and books [5] . Later the word 'tinea' came to mean any of the verminous or parasitic infestation of the skin . The term 'ring worm' came to use at about the same time and referred to any skin disease in which the lesions were arranged as rings[5] .

The dermatophytes have the ability to form molecular attachment to keratin and use it as a source of nutrients which allows them to colonize keratinized tissues, including the stratum corneum of the epidermis, hair, nail and the horny tissues of animals[6] .

In 1910 Raymond Sabouraud published his " **Les Tiegnes** " classifying dermatophytes into 4 genera based on microscopic and clinical characters: *Achorion* , *Epidermophyton, Microsporum and Trichophyton* [7].

In 1934, Emmons modernized the taxonomic scheme of Sabouraud and redefined the 3 genera: *Epidermophyton, Microsporum and Trichophyton* [7].

CLASSIFICATION OF DERMATOPHYTES

1.Mycological classification	*Epidermophyton*
	Microsporum
	Trichophyton
2.Based on habitat –	Geophilic
	Zoophilic
	Anthropophilic [8,9]
3.Clinical Classification---	Traditional based on the site of infection

ECOLOGY

Dermatophytes have been grouped into geophilic, zoophilic and anthropophilic species based on their ecology and host preference [8,9].

The geophilic ‘‘ earth loving ” organisms originate in the soil and only sporadically infect humans. These species are considered ancestral to the pathogenic dermatophytes [10]. Exposure to the soil is the main

source of infection for humans and the lower animals. Infections produced by these organisms are usually inflammatory.

The zoophilic ‘‘animal loving” species are usually found on animals but are also transmitted to humans. They have gradually evolved from soil to parasitize humans [10]. Human infections are acquired either by direct contact or with an infected animal or indirectly by contact with fomites or other inanimate objects associated with the keratinous material from the animal. Exposed areas like scalp beard, face and extremities are favored sites of infection. This type of organisms also cause inflammatory type of lesions.

The anthropophilic ‘‘man-loving” species have adapted to humans as host and transmission can occur directly or through fomites. The evolution from saprobic life in the soil to an almost exclusive existence as colonizer of keratinized tissue corresponds to a decrease or loss of conidial formation[10]. Also loss of sexual reproduction is observed in almost all of the anthropophilic dermatophytes with the

exception of *Arthroderma vanbreuseghemii*, whose anamorphs maybe *Trichophyton mentagrophytes var interdigitale* [11].These fungi generally tend to produce chronic infections that are less likely to resolve spontaneously[9] .

TINEA PEDIS

Tinea pedis is the dermatophyte infection of the feet, principally involving the toe webs and soles. It is the most common dermatophyte infection in the UK and North America[12], and probably throughout the developed world. It is said to be t he penalty of civilization in such countries. The prevalence of tinea pedis is attributable to modern occlusive foot wear and increased worldwide travel[10]. Hong kong foot is the other common term used to refer to tinea pedis. 'Hong Kong foot' is a literal translation of the Chinese slang term for athlete's foot which is read as xiāng gǎng jiǎo .

Tinea pedis has afflicted humanity for centuries, so it is perhaps surprising that the condition was not described until Pellizzari did so in 1888. The first report of tinea pedis was in 1908 by Whitfield, who with Sabouraud, believed that tinea pedis was a very rare infection caused

by the same organisms that produce tinea capitis. Most commonly caused by Trichophyton rubrum, a dermatophyte initially endemic only to a small region of Southeast Asia and in parts of Africa and Australia. Interestingly, tinea pedis was not noted in these areas then, possibly because these populations did not wear occlusive footwear. The colonization of the Trichophyton rubrum endemic regions by European

nations helped to spread the fungus throughout Europe. Wars with accompanying mass movements of troops and refugees, the general increase in available means of travel, and the rise in the use of occlusive footwear have all combined to make Trichophyton rubrum the world's most prevalent dermatophyte[13].

The first reported case of tinea pedis in the United States was noted in Birmingham, Alabama, in the 1920s. World War I troops returning from battle may have transported Trichophyton rubrum to the United States.

EPIDEMIOLOGY

In the developed world at any one time as many as 10% of the total population maybe expected to have dermatophyte infection of the toe clefts[14,15]. The incidence of tinea pedis is higher among those using

communal baths, showers and pools. Living in an institution where washing facilities are shared is likely to increase the chances of infection[14,16].It can also be transmitted well within the family bathrooms[17].The damage to the stratum corneum due to maceration and moist condition favours the growth of the organism[18].Thus the exogenous exposure to the fungus and as well as host factors play an important role in causing the clinical disease [19].

AGE AND SEX DISTRIBUTION

The condition is more common in adults than in children and mean age of onset was 15 years in one survey[8]. Adult males have 20% chance of developing tinea pedis while among women only 5% are likely to become chronically infected. The sex difference can be partly explained by the exposure to the causal fungi. The major factor is the choice of footwear, men generally wearing more occlusive and heavier footwear than women. Tinea pedis is very rare among the people who go bare feet[20] .

DERMATOPHYTES CAUSING TINEA PEDIS

The three anthropophilic species *Trichophyton rubrum*, *Trichophyton mentagrophytes var interdigitale* and *Epidermophyton floccosum* are responsible for the vast majority of cases of tinea pedis throughout the world[21]. Prior to 1970 , *Trichophyton mentagrophytes var interdigitale* infection was higher than *Trichophyton rubrum* in the ratio 8:1[22]. But the pattern has changed since 1980's and *Trichophyton rubrum* is the leading cause. Now *Trichophyton rubrum* is the most common isolate in various studies with isolation rate ranging from 45.74% [23] to maximum of 93 % [24,25].

In countries where *Trichophyton violaceum* is common , intractable foot involvement by this species is sometimes seen [26]. Trichophyton tonsurans is another anthropophilic fungus that causes tinea pedis. T*richophyton* tonsurans is not a common cause of tinea pedis but its prevalence is increasing in North America [27]. Microsporum canis is a zoophilic fungus is also one of the rarest cause of tinea pedis infection being transmitted from dogs [27].

PATTERN OF INFECTION

Combined infection: In one person more than one species is present in the same lesion.

Concurrent infection: Different species are found in different lesion at the same time.

Consecutive infection: At a single site different organisms are present on different occasions[21].

PATHOGENESIS

Two factors playing crucial role in the establishment of tinea pedis infection are:

1. Trauma.

2. Increased hydration and maceration of skin [18].

There are many obstacles that have to be overcome by a superficial fungus before it manifests its crucial pathogenesis. Obstacles to be overcome by superficial fungi [28] are UV light, variation in temperature, competition from normal flora, the fungistatic fatty acids like undecenoic acid and fatty acids with chain length 7,9,11 and 13.

3 main initial steps that are needed for a dermatophyte infections to successfully manifest are:

1. Adherence to keratinocytes

2. Penetration through and between cells

3. Development of host response

Adherence:

Human stratum corneum provides the nutrition for the dermatophytes and the growing fungal mycelia. Infectious arthroconidia adhere to keratinocytes after which germination occurs. The germination of arthroconidia and hyphal prolongation which follows adherence proceeds radially [29].

Penetration:

This is accomplished by the secretion of protienases, lipases and mucinolytic enzymes which also provides nutrient to the fungus[29] . Spores must germinate and penetrate the stratum corneum at a rate faster than desquamation. Trauma and maceration also facilitate penetration and are important factors in the pathogenesis of tinea pedis. Dermatophytes produce a variety of proteolytic enzymes which range in size from 20 to over 200 kDa [30]. There is evidence that in *Trichophyton mentagrophytes* both cell free and and a membrane bound keratinases are present.

Host defense:

The natural defense against dermatophyte depends on immunological and non immunological mechanisms[31] .

There is evidence for increased turnover of epidermis which provides the primary defense by the epidermis[32]. In an annular infection there is four fold increase in epidermal turnover at the periphery .The inflammatory response at the periphery stimulates epidermal turnover in an effort to shed the organism, while those just ahead

maintain the infection. The annular appearance of dermatophyte infection is compatible with the above observation [33].

Next defense is provided by the saturated fatty acids of the sebaceous glands. Thus the natural resistance maybe due to increase in fungistatic and fungicidal long chain saturated fatty acids. Once the deeper layers of epidermis are reached competition for iron by unsaturated transferrin is the next obstacle which is called the "Serum Factor"[34]. Transferrin binds to iron that dermatophyte need for continuous growth.

Once the fungal hyphae invade the viable tissues, their cell wall activate the alternate complement pathway resulting in neutrophil chemotaxis [35,36]. These cells adhere to the opsonised fungal hyphae and kill them through myeloperoxidase [MPO-H_2O_2-Cl] pathway. Thus they prevent invasion and sepsis by the dermatophytes even in the absence of specific immunity. Cytotoxins produced by these mechanisms were found to be fungicidal for *Trichophyton rubrum*[37].

Antibody formation does not appear to be protective in dermatophyte infections , as patients with widespread infections may

have elevated antibody titres[38] . The presence of elevated IgE is associated with chronicity. Development of cellular immunity via the sensitized T lymphocytes is the key factor in immunological defense. IFN gamma producing type I T-helper lymphocytes are mainly responsible and appearance of inflammation correlates with the development of delayed type skin reactivity to Trichophytin[39].

Thus cell mediated immunity is the cornerstone of host defense and instrumental in eradication of the fungus. It provides protection from re-infection after primary dermatophytosis[36,40]. When a patient who has not been infected with dermatophyte are experimentally infected with *Trichophyton mentagrophytes*, the initial response is that of mild inflammation and scaling and the trichophytin test is negative. After the development of cell mediated immunity the infected area becomes less inflammatory and the infection spontaneously resolves. If a second infection by the same organism is produced in the same subject at a later stage, the site becomes inflamed very early and resolves relatively quickly.

CHRONIC INFECTION

The reason for chronic infection and failure of immunity is poorly understood. A high proportion of patients with persistent infection have atopy with raised IgE levels. Modulation of T lymphocyte activity maybe responsible either locally or systemically by the deviation towards

Th 2 pathway and production of non protective antibodies. *Trichophyton rubrum* is suited to survive on skin surface and it uses different strategies. It makes more mannan that usually suppresses cell mediated immunity[41,42]. Mannan act by inhibiting the critical step in antigen processing or presentation thus inhibiting immune reaction induction [43]. *Trichophyton rubrum* is not aggressive when compared with other species. By remaining in stratum corneum, it may evade immune surveillance, complement and polymorphs. Spores can survive off the body and remain plentiful in human habits.

DERMATOPHYTIDE REACTION

Inflammatory eczematous allergic skin reactions at sites distant from the primary fungal infection which are KOH and culture negative[44]. These reactions are associated with a delayed type hypersensitivity

response to trichophytin test and may involve a local delayed hypersensitivity response to systemically absorbed fungal antigen [44,45].

PREDISPOSING FACTORS OF TINEA PEDIS

Occlusion

Occlusion of infected site appears to increase the susceptibility to experimental infection because it increases hydration of the underlying skin and emission of Co_2 ,helping dermatophyte growth[46]. Tight fitting footwear or ill fitting footwear and usage of non absorbable socks are the main factors predisposing to chronic and recurrent foot infection. Thus the use of macerating occlusive footwear has made tinea pedis and onychomycosis much more common in industrialized nations [47].

Hyperhidrosis

People with increased sweating especially of palmoplantar hyperhidrosis have increased incidence of fungal infections[48].

Immunosuppression

Chronic infection has been noted in a number of patient groups such as in those with chronic mucocutaneous candidosis, ichthyosis, AIDS[49], patients on corticosteroid therapy or with endogenous Cushing's

syndrome. Patients with AIDS though do not show increased incidence of infection can have atypical and extensive forms of presentations . Thus in HIV where the cell mediated immunity is

affected drastically, it is interesting that only the severity of dermatophytosis is increased and not the prevalence[47].

Diabetes

There is no reliable evidence that diabetic patients are especially susceptible to dermatophyte infection even though diabetes may affect the course of infection. Recently studies [50] have shown that diabetic patients are more prone to chronic infection and also the incidence of onychomycosis is increased among the patients with tinea pedis and diabetes. The dry moccasin type tinea pedis is often underestimated by diabetics as dry skin[51]. Recurrent *Trichophyton rubrum* infection are common in diabetes mellitus patients[52].

Climate

In tropical country like ours warm, humid climate is another predisposing factor which when combined with occlusive factors compound the clinical picture.

HISTOPATHOLOGY

The clinical appearance of various forms of dermatophytosis are the result of combination of direct damage to the keratinized tissues by the fungus and inflammatory host response. At one extreme there is the simple hyperkeratosis seen; at the other end is the pustular highly inflammatory type of infection most commonly caused by the zoophilic organisms[53].

Trichophyton rubrum may provoke the epidermal changes seen in chronic dermatitis with hyperkeratosis, patchy parakeratosis, hypergranulosis or hypogranulosis, spongiosis, mononuclear invasion and mild or moderate acanthosis. The accompanying dermal infiltrate of lymphocytes and histiocytes is largely perivascular. The picture may be more inflammatory with superficial crusting and the more acute inflammatory changes in the epidermis may at times become vesicular to the extent of mimicking acute contact dermatitis. The fungi appear only in the horny layer and can be seen with Periodic Acid Schiff and Gomori's methylene blue stains. In hematoxylin-eosin stain they are seen as faint basophilic refractile structures. They are usually "sandwiched" between two zones of cornified cells with orthokeratotic

upper layer and partially parakeratotic lower layer. This is known as the "sandwich sign" [54].

CLINICAL TYPES OF TINEA PEDIS

Tinea pedis may present as any of the four forms or as a combination of any of these patterns.

Chronic intertriginous type [Interdigital type]:

Interdigital tinea pedis is the most common form which begins as scaling, erosion and erythema of the interdigital and sub digital skin of the feet particularly between lateral three toes. The infection can spread to the adjacent sole and instep, rarely to the dorsum of feet[55]. Patients often complain of itching and burning sensations on the feet accompanied by malodor. There are generally two types of interdigital tinea pedis. The first is a scaly, dry type called **dermatophytosis simplex**. The skin of the interdigital space is dry with low-grade peeling. This form is usually asymptomatic except for occasional pruritus. The second type is symptomatic and presents with wet, macerated interdigital spaces. **Dermatophytosis complex**, as it is called, may have fissuring of the interspace along with hyperkeratosis, leukokeratosis, or erosions · Wet conditions along with fungal invasion increases the incidence of bacterial infection in these patients by breaching cutaneous integrity [56].

Chronic hyperkeratotic type [Dry type]:

More severe, prolonged form of tinea pedis that covers the bottom and lateral aspects of the foot. Its appearance is that of a slipper or moccasin covering the foot, hence the name “moccasin- type” tinea pedis. This type is usually bilateral with patchy or diffuse involvement . *Trichophyton rubrum* is the commonest agent causing this type. Unilateral tinea manuum commonly occurs in association with this variety resulting in ‘‘two feet-one hand syndrome”. Subungual onychomycosis coexisting with moccasin type dermatophytosis is most often caused by *Trichophyton rubrum* as well. The differential diagnosis to be considered here are psoriasis; dyshidrotic, atopic, or allergic eczematous dermatitis; pitted keratolysis; and various keratodermas

Vesiculobullous type:

This is the third type of dermatophyte infection of the feet. Occasionally a pustular variant may be seen. This type comprises pustules or vesicles on the instep and adjacent plantar surfaces of the feet and is less common [57]. Bacterial infection needs to be considered in the differential diagnosis and ruled out by microscopy and culture . This form of tinea pedis may be associated with dermatophytide or "Ide " reaction . KOH preparations of the aspirate should be examined

for presence of hyphae. Bullous impetigo, allergic contact dermatitis, dyshidrotic eczema, and bullous disease all need to be considered in the differential diagnosis. This form is typically caused by *Trichophyton mentagrophytes var interdigitale.* Sometimes this infection can go for spontaneous cure but tends to recur under hot humid conditions.

Acute ulcerative type:

Bacterial co-infection with Gram negative organisms along with *Trichophyton mentagrophytes var interdigitale* produces this ulcerative variety. This form is complicated by fever, cellulitis, lymphangitis and lymphadenopathy.

IDE ERUPTION

The vesiculobullous and ulcerative types of tinea pedis produces this vesicular type of hypersensitivity reaction [28]. A pompholyx like ide affecting the web spaces and palmar surfaces of the fingers, palms and sometimes the dorsal surface of hands is characteristically associated with above types of tinea pedis. They can arise spontaneously or as a result of inappropriate treatment. Other types of ide eruptions are widespread eruption of small follicular papules and very rarely erythema

nodosum like, erythema multiforme like, erythema annulare like and urticarial eruptions[58].

Criteria for diagnosis of dermatophytide reaction: [PECK ' s criteria]

1. Proven dermatophyte infection which usually becomes inflammatory just before the secondary rash.

2. A distant eruption which is demonstrably free of the fungus.

3. Spontaneous disappearance of the rash when the primary infection settles with or without treatment[45].

LABORATORY DIAGNOSIS

DIRECT MICROSCOPIC EXAMINATION

The direct microscopic examination of a properly collected specimen is one of the most rapid and effective methods of detecting fungal infection.

Collection of material

Disposable scalpel blades of solid type held vertically to the skin or heat sterilized blunt banana shaped scalpels are used to get scrapings. In lesions with definite edge the material should be taken from the active

margin. When blisters are present, a pair of fine scissors may be used to cut off a blister roof for microscopical examination and culture which are packed with hyphae[21].

Examination

The solutions usually used for the examination of these specimens are potassium hydroxide or sodium hydroxide preparations, sodium sulphide solution, calcofluor white and the periodic acid-Schiff [PAS] stain[7]. Potassium hydroxide 10 – 30% is the most commonly used solution.

Potassium hydroxide

KOH is the most widely used preparation for the direct examination of clinical specimens for the presence of fungi.

A drop of 10% KOH is placed on a slide and a small amount of the specimen is added to the drop, a cover slip is placed over it and the preparation is gently heated .The KOH softens and clears the specimen for easier detection of the hyphae by digesting any proteinaceous debris. Several modifications of the basic 10% KOH preparation have been made for more rapid detection. Parker super chrome blue black

Quinck permanent fountain pen ink is added for selective staining of the

fungus[10]. 36% DMSO with 20% KOH aid in preparation and clearing of specimen without heating but over digestion is a problem[58]. The slides are examined under the microscope with reduced light by lowering the condenser and adjusting the condensor's diaphragm.

The artifacts that can be encountered are cotton wool or synthetic fibers and from the 'mosaic fungus'. Mosaic fungus consists of cholesterol crystals deposited around the periphery of the epidermal cells. It can be recognized by the regularity of its outline, abrupt changes in width and presence of re-entrant angles in flat crystalline structures and lack of internal organelles[10]. In experienced hands KOH preparations are the most useful and inexpensive diagnostic procedures in medical mycology.

Fluorescence microscopy

Using either Acridine orange or a fluorescence brightener such as Calcofluor white or Blankophor which specifically stains the polysaccharides of fungal cell wall diagnosis is made. The use of this technique requires a fluorescent microscope with a proper ultraviolet

source and a filter combination that is too expensive. This method has the advantage of easier fungal identification with less search time[59]. Calcofluor white can be combined with KOH for rapid clearance of

the specimens. Fungal hyphae must be differentiated from textile fibers that may also fluoresce.

Periodic Acid- Schiff

The PAS stain is based on the reaction of fungal cell wall polysaccharides with the PAS reagents, resulting in the fungus developing a red-violet fuchsin colour in the tissues.

CULTURE

Culture is a necessary adjunct to direct microscopic examination. It is only by culture we can achieve definitive identification of the etiological agent. The choice of therapy may depend upon the specific identification of the invasive mould. The situation with dermatophyte infection is rather different because all the dermatophyte species have been believed to respond similarly to the major systemic and topical antifungals available. Culture will provide valuable information on the possible sources of infection and the likelihood of spread of the disease.

Culture of specimen with negative direct microscopical result will allow the detection of small percentage of cases where prolonged therapy or a very inflammatory host reaction may make the microscopical detection of the fungus in the skin difficult[21].

A primary medium for the isolation of dermatophytes should be selective against bacteria and non dermatophytic saprobic moulds. Two such media that are commonly used are SGA (a glucose peptone agar) with cycloheximide and chloramphenicol and the dermatophyte test medium (DTM). DTM incorporates gentamicin, chloramphenicol and phenol red indicator that changes colour from yellow to red when the medium becomes alkaline [pH=8 and above] as the result of growth of dermatophytes[58]. DTM is not a specific medium for dermatophyte as it can give false positive results with non-pathogenic fungi and some systemic mycosis. It also has the disadvantage of not allowing visualization of pigmentation on the reverse of a colony a characteristic often used in identification.

Sabouraud's dextrose agar with 4% sugar, 1% peptone and an acidic pH or Emmon's modification with 2% sugar, 1 % peptone in

neutral pH are the primary culture mediums used. Chloramphenicol at 0.005% [0.05g/L] and cycloheximide at 0.05% [0.5g/L] are added to the medium to inhibit the bacterial contaminants and non dermatophyte moulds respectively. As incubation period is much longer the medium should be poured relatively thick to prevent drying out; 30ml/ 90mm petri dish is adequate. The temperature of incubation should be 26-28 C

[room temperature 78.8^0 F] and cultures should be held for a maximum of 3-4 weeks[21].

IDENTIFICATION OF ISOLATES

Identification of a dermatophyte is based on its gross colonial morphology on Sabouraud's dextrose agar and its microscopic morphology. Additional physiological and biochemical tests may be necessary in conjunction with above for accurate species identification.

COLONY CHARACTERISTICS

Gross colony features observed include, colour of the surface, colour of the reverse, production of pigment, texture of the surface (powdery, granular, velvety, suede like, downy or fluffy), topography

(flat raised or heaped up), type of folding (radial, cerebriform or crateriform) and rate of growth[7]. These features are best noted on cultures grown on petri dish than in tubes.

MICROSCOPIC MORPHOLOGY

Microscopic morphology maybe studied in teased mounts mounted in lacto phenol cotton blue (Poirrer's blue) or lactophenol aniline blue.[60] and examined for macro and microconidia. Specialisation

media maybe needed to stimulate sporulation like, cornmeal agar, potato agar, potato glucose or rice grain agar and thiamine or histidine enriched media[21].

Microscopic features to note include shape and size of the conidia, their colour, septation and the presence of wall thickenings. The arrangement of conidia on the conidiogenous cells and the type of conidiation is important. Such microscopic features maybe observed using a needle mount , a sticky tape strip or a slide culture.

The simplest method is the **needle mount** where a portion of growth is removed with stiff wire needle and mounted on stain like lactophenol cotton blue. Cover slip is placed and the slide examined.

Because of the rough handling of this method many of the conidia will be detached from hyphae.

The **sticky tape strip method** is very useful for study of conidia as the conidia are retained on the hyphae, In this method the sticky side of tape is applied to the surface of colony and then mounted in a drop of stain and examined directly through the back of the tape.

The **slide culture** is the most successful and time consuming method. In this method, fungus is inoculated on four sides of a square of

agar, sandwiched between a glass slide and a cover slip and maintained in a sterile Petri dish with a moist atmosphere. The fungus grows out from the agar block directly onto the glass of the cover slip and slide, which maybe used to prepare two undisturbed mounts of the growing fungus. When sealed with nail polish they form permanent preparations[61].

PHYSIOLOGICAL TESTS FOR SPECIES IDENTIFICTION

Urease test:

This test is done on Christensen's medium for distinction between *Trichophyton rubrum and Trichophyton mentagrophytes*. Urease

produced by *Trichophyton mentagrophytes* splits urea which raises the pH. This changes the colour of the media from amber to pinkish red due to phenol red indicator. *Trichophyton rubrum* is urease negative while *Trichophyton raubitscheki* a variant of *Trichophyton rubrum* is urease positive[62].

In vitro hair perforation test:

This test is taken as positive when the dermatophytes show wedge shaped perforations in the hair. It is positive in *Trichophyton*

mentagrophytes and *Microsporum canis* species and is negative in *Trichophyton rubrum* infection[62].

ISOLATES

TRICHOPHYTON RUBRUM

Trichophyton rubrum is probably the most morphologically variable dermatophyte species and several distinct colonial forms such as downy, dysgonic, granular and yellow forms are regularly isolated.

Downy form:

This is the most commonly isolated form in temperate zones. The surface of the colony is white, downy or cottony and domed. The

reverse of the colony is initially dark brown, usually with a paler cream border, but after incubation for 2-3 weeks produces the typical deep red pigment characteristic of this species. Microscopic examination shows small tear-shaped, clavate or elongate microconidia arranged along the sides of the hyphae. In some isolates microconidia may be scanty. Physiological tests show the fungus is urease negative and does not perforate human hair in vitro[7].

Melanoid form :

Colony is similar to the downy form, but characterized by producing a brown melanoid pigment that diffuses into the medium and masks any red pigment on the reverse of the colony. Microscopy shows small, tear-shaped microconidia are arranged along the sides of the hyphae [7].

Dysgonic form:

Slow-growing, deep-red colonies with a brittle texture is seen. This form is relatively unstable and will quickly revert to the more typical downy form.

Granular form :

The colony surface is powdery or granular, cream to pink and often raised and folded in the centre. The reverse is red-brown. Microscopy reveals numerous smooth, thin-walled, cylindrical or pencil-shaped macroconidia . Typical tear-shaped microconidia are also present. By physiological tests, this form is urease positive and will penetrate human hair in vitro. Some workers have described this variety as a distinct species *Trichophyton raubitscheckii* [7].

Yellow form :

The surface may be similar to the more usual downy form or it may be smooth, leathery and yellow. The reverse is yellow and the red pigment characteristic of *Trichophyton rubrum* is completely absent[7].

TRICHOPHYTON MENTAGROPHYTES VAR INTERDIGITALE

The most typical isolates in colony are rapidly growing with a white, powdery surface, which develops a cream centre and folded appearance. The reverse is pale cream to buff. In microscopy, spherical microconidia arranged in bunches can be seen with spiral hyphae and macroconidia present in some isolates. The fluffier, downy isolates have pyriform microconidia arranged along the sides of the hyphae. Physiological tests show that the fungus is urease positive and penetrates human hair in vitro.

The 'nodulare' form of *Trichophyton mentagrophytes var. interdigitale* has a glabrous, waxy surface devoid of aerial hyphae. Both the surface and reverse of the colony are orange-red in colour. Nodular bodies are present on microscopical examination.

EPIDERMOPHYTON FLOCCOSUM

This species grows rapidly to form velvety or suede-like colonies, which may remain flat or develop central or radial folds. The colour is typically khaki or olive green and some isolates produce tufts of floccose, sterile white mycelium on the surface of the colony.

Microscopy reveals large, clavate macroconidia with a rounded apical end and up to six cells are rapidly formed. They are thin walled and initially smooth, but may develop a few discrete thickenings as they age. Microconidia are absent. Chlamydoconidia are abundant and predominate in older cultures.

OTHERS

Polymerase Chain Reaction [PCR], based on restriction fragment length Polymorphism [RFLP] is an extremely sensitive and specific method for rapid diagnosis of dermatophytosis infection in which results can be obtained within 48 hours [63].

Less frequently used techniques to diagnose onychomycosis include immunohistochemistry, dual-flow cytometry and confocal microscopy [21].

TREATMENT

As recurrence of tinea pedis is common every effort should be made to avoid the known predisposing factors. A local dry environment over the feet and avoiding occlusive footwear as far as possible are of paramount importance. Shoes should be alternated regularly to air dry every 2 – 3 days [64]. Antifungal powders maybe placed in shoes daily. The nails in particular should be examined for onychomycosis which may act as reservoir of infection.

The palms and soles present a unique treatment problem because of the thick horny layer of skin. Mild keratolytic agents like Whitfield ointment can be used for non inflammatory asymptomatic infection. For the intertriginous type of tinea pedis any of the topical antifungal can be used in cream formulation. Any of the topical antifungal agents like an allylamine, azoles, ciclopirox olamine , benzylamine, tolnaftate or undecanoic acid can be used [65]. Topical imidazole preparations like clotrimazole, econazole and ketoconazole are now well established as effective remedies. Other drugs like miconazole, isoconazole, tioconszole, oxiconazole, sertaconazole and sulconazole are equally effective [66,67].

If the toe clefts are very inflamed and secondary bacterial infection is likely a systemic antibiotic should be administered. Severe infection, an acute presentation, extensive chronic disease or one that appears resistant to topical agents should warrant systemic antifungal agents.

Alternatives therapy is topical terbinafine, which has shown to produce response in very short periods. One week of topical terbinafine 1 % is more effective than 4 weeks of clotrimazole in tinea pedis. Topical terbinafine is 66 percent effective [68].

The newer oral antifungals have replaced griseofulvin as the treatment of choice for severe or refractory tinea pedis when accompanied by onychomycosis. The dosing schedule of terbinafine is 250 mg daily for 2 weeks. Effective regimen of itraconazole for adults are 200 mg twice daily for 1 week, 200 mg daily for 3 weeks or 100 mg daily for 4 weeks[69]. Children should receive 5 mg/kg/day for 2 weeks.

As vesiculobullous tinea pedis is the result of T cell mediated immune reaction symptomatic relief with topical or systemic corticosteroids may be warranted during the beginning for antifungal treatment [70].

Preventive measures like changing frequent footwear, drying the feet well after bathing and refraining from sharing articles including

socks can be helpful in minimizing reinfection or transmitting infection to others. The provision of tolnaftate powder at swimming baths to use it prophylactically has been shown to reduce levels of toe cleft tinea pedis caused by *Trichophyton mentagrophytes* var *interdigitale* although it had little effect on *Trichophyton rubrum.*

TINEA PEDIS- A CLINICO MYCOLOGICAL STUDY

AIM OF THE STUDY

1] To find the predominant etiological agent of tinea pedis among the patients studied.

2] To find the incidence of disease in relation to sex, age group and occupation.

3] To account for the varied clinical presentations.

4] To find the precipitating or aggravating factors of the condition.

5] To know other conditions of foot associated with tinea pedis.

6] To find out if there is any significant association with blood group and the occurrence of tinea pedis

MATERIALS AND METHODS

Seventy five randomly selected patients with tinea pedis, during the period August 2007 to September 2009, were enrolled to the study. A clinical diagnosis of tinea pedis was made by the presence of scales, fissuring and morphology of the lesions and all cases of tinea pedis were first confirmed by KOH examination .

Age, sex and duration of the disease were recorded. A detailed history was obtained in all the patients with regard to socioeconomic status, occupation, about the habit of shoe wearing, any similar episodes in the past with exacerbation during summer months or associated with hyperhidrosis. Any contact with pet animals and living in institutions with habit of sharing of shoes or socks, similar illness among the residents or the family members were especially enquired into. History of any systemic illness and treatment were also recorded.

The dermatological examinations included the clinical type of infection with areas of involvement. Particular importance was given to the presence of any anatomical deformities of the foot, spacing between the toes and the nature of sweating. Any other associated dermatological condition of the foot were also noted. Screening for dermatophyte

infection over other areas of skin and nails especially the palms for ide eruptions were done. Systemic examination and screening for other dermatological disorders were done in all the patients.

In all the 75 patients, mycological examination of the skin scrapings from the affected site or blister top specimens from the vesiculobullous lesions were carried out in wet mount in 10% potassium hydroxide (KOH). Isolation of the agent was done through inoculating the specimen (scales or crusts) in Modified Sabouraud's Dextrose Agar medium with cycloheximide. The isolates were studied with regard to macroscopic, microscopic colony morphology and pigment production. Differentiation of the species was done by culturing on corn meal agar and looking for the persistence of pigmentation.

OBSERVATION

SEX DISTRIBUTION

Out of the 75 patients enrolled into the study 52 [69.3%] were males and 23 [30.7%] were females.

Table - 1

SEX	NUMBER (n=75)	PERCENTAGE
Male	52	69.3%
Female	23	30.6%

M:F= 2.26:1

FIGURE- 1

AGE DISTRIBUTION

The youngest patient in the study was a 5 year old male child and the oldest a 60 year old man. Majority of patients were in the age group 21 – 30 years.

TABLE- 2

S:NO	AGE	MALE	FEMALE	PERCENTAGE
1	0 - 10	1	1	2.6%
2	11 – 20	7	3	13.3%
3	21 – 30	24	8	42.6%
4	31 - 40	13	5	24.0%
5	41 - 50	6	4	13.3%
6	51 - >	1	2	4.0%

AGE DISTRIBUTION

FIGURE- 2

ASSOCIATION WITH SHOE WEARING

Among the patients studied shoe wearing habit has been noted in only 23 cases. Most of these patients are students and others were policemen , drivers and businessmen who must wear shoes as routine as their occupation demands.

TABLE -3

TOTAL CASES	n=75	PERCENTAGE

Shoe wearing	23	30.6%
Non shoe wearing	52	69.3%

FIGURE- 3

SHOE WEARING -OCCUPATION WISE DISTRIBUTION

TABLE -4

S : NO	OCCUPATION	NUMBER
1	Student	8
2	Policemen	4
3	Business	2
4	Security	2
5	Driver	2
6	Cook	1

FIGURE -4

EPISODE OF TINEA PEDIS

In the study 67 cases presented to us with tinea pedis for the first time and 8 patients had recurrent episode. 7 patients with recurrent episode were having regular shoe wearing habit. Bilateral affection of foot by tinea pedis was seen in 7 patients [9.3%].

TABLE- 5

EPISODE	NUMBER	PERCENTAGE
First	67	89.3%
Recurrent	8	10.6%

SYSTEMIC ASSOCIATIONS

Among the 75 patients studied 12 patients were diabetics [16%] . Hyperhidrosis as associated in 11 patients [14.6%]. 7 patients gave history of atopy and 2 patients were known HIV positives .

TABLE -6

SYATEMIC ASSOCIATION	NO OF PEOPLE
Diabetes	12
Hyperhidrosis	11
Atopy	7
HIV	2
Renal transplant	1
Ichthyosis vulgaris	1
Urticaria	1

BLOOD GROUP DISTRIBUTION

The blood group distribution in dermatophytosis patients demonstrated that 37.3% of the patients belonged to group O+, 32 %

to group B+ and 21.3 % to group A+. Other blood groups found were AB +ve 4 cases, AB- ve 2 cases and 1 patient O –ve.

TABLE- 7

BLOOD GROUP	NUMBER OF PEOPLE	PERCENTAGE
O +	28	37.3%
B+	24	32%
A+	16	21.3%
AB+	4	5.3%
AB-	2	2.6%
O-	1	1.3%

FIGURE-5

ASSOCIATION WITH OTHER TYPES OF DERMATOPHYTOSIS

Tinea pedis was an isolated entity in 46 patients [61.3%]. Among the remaining, 29 patients [38.7%] had other types of dermatophytosis and 11 patients studied had associated tinea unguium

infections. Ide eruption was seen among 2 patients with vesiculobullous tinea pedis.

TABLE - 8

Types of dermatophytosis associated with tinea pedis	Number of Patients
Tinea unguium	11
Tinea cruris	6
Tinea corporis	5
Tinea manuum	2
Extensive dermatophytosis	4
Tinea capitis	1

ASSOCIATION OF OTHER FOOT DERMATOSES

The foot was examined for the presence of other dermatosis and the other dermatosis associated are given in the following table. Traumatic fissure was the most common finding seen among 15 patients. Crowding of toes was noted in 8 patients.

TABLE- 9

Other foot dermatoses	Number of patients
Traumatic fissure	15
Wart	6
Keratolysis punctata	5
Corn foot	4
Chromoblastomycosis	1

THE VARIOUS TYPES OF TINEA PEDIS OBSERVED

Of the 75 patients, 65 patients [86.7%] had a single clinical type fitting into the 4 major forms. Other 10 cases [13.3%] presented with combination of two types of the clinical varieties. The type of tinea pedis and the organism isolated with each are recorded in the table given below.

TABLE- 10

TYPE OF T PEDIS	TOTAL NUMBER	PERCENTAGE
Interdigital	36	48%
Hyperkeratotic	20	26.6%
Vesiculobullous	7	9.3%
Ulcerative	2	2.6%
Interdigital +Hyperkeratotic	7	9.3%
Vesiculobullous +interdigital	3	4%

FIGURE- 6

WEB SPACE AFFECTED

Total number of interdigital type of tinea pedis = 36

The predominant web space involved was the 3rd space with a total of 15 patients. Next commonly involved was both the 3rd and 4th web spaces together with 10 cases.

TABLE - 11

WEBSPACE	NUMBER OF CASES	PERCENTAGE
1ST	2	5.5%
2ND	4	11.1%
3RD	15	41.6%
4TH	5	13.8%
3RD & 4TH	10	27.7%

FIGURE-7

CULTURE POSITIVITY

Positive isolates were obtained in culture among 61 patients from the total 75 patients, giving the culture positivity rate of 81.3%.

FIGURE- 8

ORGANISM ISOLATED

Distribution of isolates

TABLE- 12

S.No	Type	Number of cases [n = 61]	Percentage
1	Trichophyton rubrum	47	77.04%
2	Trichophyton mentagrophytes	14	22.95%

FIGURE- 9

TYPE OF TINEA PEDIS AND THE ORGANISM ISOLATED

Table -13 below gives the various organisms isolated and the morphological type with which they were associated.

TABLE - 13

TYPE OF TINEA PEDIS	TOTAL NUMBER	ORGANISM ISOLATED	
		T rubrum	T mentagrophytes
Interdigital	36	22	4
Hyperkeratotic	20	18	1
Vesiculobullous	7	1	5
Ulcerative	2		1
Interdigital+Hyperkeratotic	7	6	
Vesiculobullous +interdigital	3		3

The macroscopic morphology of the colony of *Trichophyton rubrum* was downy with the diffusible red pigment on the reverse. On Lactophenol cotton blue staining, microscopically the hyphae were thin with few to plenty of microconidia both in enthyrse and engreppe distribution. Pencil shaped macroconidia were also seen. Subcultures in corn meal agar produced diffusible red pigment characteristic of *Trichophyton rubrum*.

The macroscopic colony of *Trichophyton mentagrophytes* appeared as white powdery colony on the surface which in some cases developed a cream centre. The reverse appeared tan to golden in colour with no pigment production. On microscopic examination, spherical microconidia arranged in bunches and linear distribution around the hyphae were seen. Spiral hyphae and macroconidia were present in some isolates. Subcultures in corn meal agar did not produce any diffusible red pigment into the medium.

DISCUSSION

Out of the 75 cases taken in our study 52 were males and 23 were females. This gave a male: female ratio of 2.26: 1. This is in accordance with the previous study by Bindu et.al [71] and other studies on tinea pedis by Singh K A et al [72] which all showed male predominance. Lack of shoe wearing and indoor dwelling among females explains to some extent the male predominance in incidence observed in all these studies.

All the studies conducted previously by Banerjee et.al [73] Maheshwari. A et.al.[74] and Singh K.A. et.al [72] showed that maximum number of patients belonged to the age group 21 – 30 years. In our study also the maximum patients were seen in the 21-30 year age group (32 patients, 42.6%), in agreement with the previous studies. But the study by Bindu et al [71], have reported higher incidence of tinea pedis in the second decade . This higher incidence may be attributed to more participation in active field work, high incidence of hyperhidrosis and shoe wearing encountered in this age group. The youngest patient is a 2 years old male child and the oldest a 60 year old man. Average age

group in the study was 28.78years . Majority of patients belonged to the middle and lower income groups.

Shoe wearing habit has been noted in 23 patients (30.6%) . Among the 23 patients who have the habit of shoe wearing in our study the maximum were students [34.7%] followed by policemen, businessmen and car drivers whose occupation compels them into the habit of shoe wearing. Tight fitting occlusive footwear, and usage of non absorbable socks were the most important predisposing factors which caused fungal infection in these patients. In the West it has been called penalty of civilization as tinea pedis has been the predominant type of dermatophyte infection among the most active younger age group people.

Hyperhidrosis was associated with tinea pedia is 11 cases (14.6%). Bilateral affection of foot by tinea pedis was seen in 7 patients [9.3%]. Such bilateral involvement was observed in the regular shoe wearing population especially school and college students. Among the patients 8 of them had recurrent episode of tinea pedis at presentation and others in the study presented with their first episode. Like the bilateral involvement of the foot, recurrent episodes were also found in the majority of regular shoe wearing population.

Among the 75 patients 12 patients are diabetics (16%). Among the 12 cases 5 were newly diagnosed as diabetics on investigation and 7 were already known diabetics. The prevalence rate of diabetes among the patients in our study is less when compared to study by Abbas Ali et.al [75] which recorded 24.8%. In our study 6.6% of patients turned out to be diabetics on screening. Diabetes is one of the most important predisposing factor for foot diseases including tinea pedis among the elderly age group patients. The compounding factors of immune suppression, local trauma and vascular problems that are associated with diabetes make the person more susceptible to fungal foot diseases[76]. Any patient diagnosed with tinea pedis should be screened for diabetes as routine.

Atopic diathesis history was obtained in 7 cases (9.3%).Among the patients 2 were known HIV positive patients (2.6%). One patient had extensive dermatophytosis . Usually dermatophytosis is not associated with an increase in prevalence in a HIV positive patient. Patients with HIV though do not show increased incidence of infection, can have atypical and extensive forms of presentation. Thus in HIV patients where the cell mediated immunity is affected drastically, it is interesting that only the severity of dermatophytosis is increased and not the prevalence [47].

Gamborg-Nielsen [77] while evaluating patients with hereditary palmoplantar keratoderma and dermatophytosis found higher frequency of individuals from group A infected by *Trichophyton mentagrophytes*.

Similarly, Balajee *et al* [78] suggested that individual from group A are more susceptible to dermatophyte fungi infections, once they found an increased percentage of patients belonging to this blood group when compared to the control group. But the study results of Neering et al [79] and from the study done in our hospital by Sentamil Selvi et al [80], no significant association with specific blood group and increased incidence of fungal infection has been proved. The blood group distribution in our study showed 37.3% of patients belonging to blood group O +ve , 32% patients belonging to B+ve group, 21.3% patients belonging to A +ve and rest 9.4% to other groups. This distribution reflects the blood group prevalence that is noted in the general population.

Intertriginous scaling type with slight extension to the adjacent plantar and dorsal surface was the commonest presentation observed in these series (36 cases,48%) followed by scaling hyperkeratotic type in 20 cases (26.6%). The vesiculobullous type of tinea pedis came next with 7 cases and the least common was the ulcerative type with 2 cases. Mixed types were observed in 10 patients. 7 patients with

interdigital and hyperkeratotic variety and 3 patients with interdigital and vesiculobullous variety.

As per the literature and the study by Abbas ali et.al [75], 4th web space and 3rd web space were the most commonly involved sites. In our study, among 36 patients with the interdigital type of tinea pedis, the web space most commonly involved was the third with 15 patients presenting with such involvement which is in coherence with above study. Both 3rd and 4th web spaces were involved in 10 patients. Fourth web space was involved in 5 patients, second web space in 4 patients and first web space in 2 patients.

On examination of foot anatomical problems like crowding of toes was found in 8 of the patients studied. 5 patients had associated keratolysis punctata . Most were women who had history of frequent immersion in water for long periods during the house hold works. The maceration and trauma associated with such predisposition are the major factor responsible for the occurrence of tinea pedis among the house wives who does not have the habit of shoe wearing or other factors that usually predispose men for fungal infection . Other foot problems noted were traumatic fissure in 15 patients, plantar wart among 6 patients and corn foot in 4 patients.

As per study by Jacek et.al.[76] one third of patients with toe nail onychomycosis had tinea pedis. Infected toe nails may be the site of primary infection and fungal disease can spread to other body areas from them. In a study by Zais et.al.[81] also one third of patients with toe nail onychomycosis had tinea pedis. Other dermatophyte infections noted among the patients with tinea pedis, in our study , tinea unguium was the most commonly associated problem among 11 patients (14.6%).The toe nail involvement was seen in 9 cases.

Tinea cruris was the next common dermatophyte infection among the tinea pedis patients with 6 patients, followed by tinea corporis 5 cases and tinea manuum 2 cases. A 13 year old school student who presented with vesiculobullous type of tinea pedis had associated tinea capitis. Two cases of acute vesiculobullous type of tinea pedis had associated allergic vesicular ide eruption of hands. 4 patients were diagnosed with extensive dermatophytosis . Among them one patient was diagnosed with chromoblastomycosis left foot who also had extensive dermatophytosis.

The previous studies by Singh K.A. et.al[72] and Sentamil selvi et al [80] recorded *Trichophyton rubrum* to be the most common isolate. Our study results were in accordance with the above studies. Some workers

Allen S et al, Sharma NL et al , Attye A et al [82,83,84] have recorded *Trichophyton mentagrophytes* as the chief isolate from tinea pedis cases . But most other reports by Ramanan C et al, [85,86] Banerjee U et al [73, 87] are in keeping with the trend observed in the present series in which *Trichophyton rubrum* is the most common isolate. In our study culture positivity was recorded in 81.3% (61 cases) of cases studied. This positivity rate is higher in our study when compared to similar study by K.A.Singh et al which recorded a positivity of 72.55%. Among the culture positive isolates *Trichophyton rubrum* was isolated in maximum patients. Sharing 47 (77.04%) of 61 isolates, *Trichophyton rubrum* happened to be the chief isolate among all. 85.1% (40 isolates) of it belonged to either dry hyperkeratotic or interdigital scaling type of tinea pedis.

Rest of the 14 isolates was *Trichophyton mentagrophytes* which contributed to 22.95 % of isolates. *Epidermophyton floccosum* was not isolated from any of the culture specimens. In study by Singh A .K et.al[72] *Epidermophyton floccosum* formed the 3rd common isolate accounting for 8.11% of cases.

Some studies by Abbas Ali et al and Ramanan C et al [75,85] have correlated the dry squamous or hyperkeratotic lesions of tinea pedis with *Trichophyton rubrum* on one hand and wet vesicular lesions with *Trichophyton mentagrophytes* on the other. We have recorded the isolates almost in complete agreement with it. But in one case of bullous tinea pedis *Trichophyton rubrum* was the organism isolated. Similar observation was noted in a study by Maroon and Miller [88] who have isolated *Trichophyton rubrum* from a 2 year old girl who presented with vesiculobullous tinea pedis.

CONCLUSION

Prevalence of tinea pedis infection was more common among males with male: female ratio of 2.26:1.

The 21- 30 years age group was commonly affected by tinea pedis. The mean age was 28.8 years.

Shoe wearing habit has been encountered among 30.6% of patients. Most of them were school or college students and policemen who have to wear shoes compulsorily.

More incidence of bilateral involvement and recurrent episodes were noted among the shoe wearing population than in the non shoe wearing population

Bilateral involvement was seen in 9.3% and hyperhidrosis was associated among 14.6% patients.

Any patients diagnosed with tinea pedis should be screened for diabetes as implied by the outcome of the study. Among the 12 patients who were associated with diabetes 5 were newly diagnosed patients after our investigation.

The blood group distribution in our study showed 37.3% of patients belonging to blood group O +ve. The distribution of blood groups reflected the general distribution pattern of the population.

Intertriginous type of tinea pedis was the most common type observed in this study in 36 patients. 3rd web space was the most commonly affected with involvement seen in 15 patients.

4 patients had extensive dermatophytosis and ide eruption was observed in 2 patients.

Among other dermatophyte infections observed in the patients with tinea pedis, tinea unguium was the most commonly associated problem in our study with 11 patients (14.6%). Infected toe nails may

be the site of primary infection and fungal disease can spread to other body areas from these primary sites.

Other foot abnormalities observed were crowding of toes, traumatic fissures, keratolysis punctata, corn foot and plantar wart.

Culture positivity was recorded in 81.3% (61 cases) of cases studied.

Trichophyton rubrum happened to be the chief isolate. Among the 61 culture positive specimens *Trichophyton rubrum* was isolated in 47 cases.

Trichophyton mentagrophytes was isolated from the rest of the tinea pedis patients.

Trichophyton rubrum was isolated more commonly from the dry squamous or hyperkeratotic lesions of tinea pedis and T*richophyton mentagrophytes* was isolated from wet vesicular lesions.

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PROFORMA

NAME :

AGE : Address :

SEX : Phone no. :

OP No. :

Occupation :

occupation requiring shoe wearing

exposed to warm humid environment

H/o PRESENTING ILLNESS

Accustomed to wearing shoes and socks.
H/o living in institution where facilities are shared.
H/o any hyperhidrosis.
H/o contact with pet animals.
H/o exacerbation in summer hot months.
H/o suggestive of Atopy.
H/o similar illness in family or other members.

PAST HISTORY

A. Similar complaints in the past.

B. Diabetes / Hypertension / Tuberculosis / Bronchial asthma.

PERSONAL HISTORY

A. Diet B.Habits

GENERAL EXAMINATION

Anemia , Malnutrition

Obesity

Nature of sweating

Pulse rate

SYSTEMIC EXAMINATION

Cardiovascular and respiratory system

LOCAL EXAMINATION OF FEET

The nature of the feet in general for any anatomical deformities.

Shape and size of the toes.

Space between the toes---tight, crowded or widely spaced.

Sole of the foot-for lesions of tinea pedis.

Any associated condition like traumatic fissure or keratolysis punctata.

Dorsum of foot for involvement.

Nature of sweating.

Vascularity of foot.

Nail changes.

Nature of lesion- Morphology and sites of involvement.

OTHER EXAMINATIONS

Both palms –tinea manuum lesion , 'ide' –eruption

Whole body and other intertriginous areas

Associated tinea cruris, tinea corporis, tinea manuum or tinea capitis

INVESTGATIONS

Urine—albumin/ sugar

Blood haemogram

Blood sugar

Blood grouping

ELISA

MYCOLOGICAL TESTS

Culture in SDA Agar

Culture in Corn meal Agar

Lactophenol Cotton Blue mount

DIAGNOSIS

TREATMENT

ADVICE

FOLLOW UP